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– RESEARCH REPORT –

Protocols for Organising Radiocarbon Dated Assemblages from New Zealand Archaeological Sites for Comparative Analysis

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ABSTRACT

A set of protocols developed to organise radiocarbon dated archaeological assemblages from New Zealand in preparation for comparative analysis is presented. These concern sample selection and admissibility criteria, and a set of rules for using both 1σ and 2σ calibrated age ranges to assign assemblage dates to periods. Examples drawn from a comparative study currently being undertaken are used to illustrate application of the protocols, and brief observations are made on the distributions in time and space of assemblages under analysis in this case study.

Keywords: New Zealand, chronology

INTRODUCTION

Archaeologists have long recognised both intriguing opportunities for the study of cultural, social and environmental change provided by New Zealand's short human history, and the considerable challenges in doing this effectively with the dating methods that are at their disposal (Shawcross 1969). These issues have been brought into sharper relief in recent years through the chronometric hygiene revolution which further abbreviated the period of human settlement (Anderson 1991; Wilmshurst *et al.* 2008), and also relegated to an 'undated' status many of the sites on which models of cultural, economic and environmental changed had been founded (Smith 2008). There is now more than ever a critical need to reassess the nature and timing of changes in material culture, subsistence patterns and environment.

An important component of such reassessment involves comparisons of data from multiple assemblages of similar age in order to determine how much inter-site and inter-region variation there was at any one time, so that the functional and spatial components of variation can be isolated from those that reflect the passage of time. Critical to this process is the question of what constitutes 'similar age' when grouping sets of assemblages for comparison. Given that the objective is to reassess the data that underlay previous models of change, age groupings based upon predictions of those models, such as the presence or absence of particular artefact forms or faunal classes cannot be employed. Clearly an independent timescale is required. While other methods are available, radiocarbon dating is the major form of chronometric evidence used in New Zealand, and can provide the independent time scale necessary for studies of the sort advocated here.

It is also necessary to select points or zones along the time scale that will serve as watersheds for placing assemblages into groups of similar age. For this I advocate an experimental approach, in which various potential subdivisions are trialed and refined through comparative analyses, providing the opportunity to identify variations in the timing of changes in different parts of the cultural, subsistence and environmental systems. One difficulty that arises, irrespective of where such 'period' boundaries are placed, is that they will be spanned by some of the calibrated age ranges for assemblages that are of interest. An approach to dealing with this problem was recently developed as part of a major comparative study currently being undertaken, and it is presented here both to set out the basis for the chronological organisation of that study, and to make it available to others who may wish to employ it.

METHOD AND CASE-STUDY

The study in question is a review of archaeozoological evidence for pre-European human use of marine resources in two New Zealand study areas (Smith & James-Lee 2009), which contributes to a broader investigation of the nature and causes of changes in New Zealand's marine shelf ecosystems over the timescale of human occupation (McDiarmid n.d.). It involves examination of faunal identification data from 107 archaeological assemblages; 75 of these from 48 archaeological sites in the Greater Hauraki study area, which extends from just south of Whananaki to Waihi

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Beach on the east coast of the North Island, and 32 assemblages from 19 sites in the Otago-Catlins area, from just north of Oamaru to Slope Point on the east coast of the South Island. These assemblages were selected on the basis of two criteria, the availability of quantified taxonomic identifications for all or most classes of fauna represented and the availability of reliable chronological information.

For this purpose four period designations were established: *Early* (ca. 1250–1450 AD), *Middle* (1450–1650 AD), *Late* (1650–1800 AD), and *Historic* (post-1800 AD); although for the study in question only the first three were utilised. These periods were organisational units designed specifically for the broader investigation into changes in marine shelf ecology (McDiarmid n.d.; Smith and James-Lee 2009), without any prior expectation or prediction that they might also represent divisions in cultural, economic or environmental change. Indeed, part of their purpose was to explore what, if any, changes there were in human exploitation of marine resources, and identify where closer scrutiny and refinement of the time scale might be necessary to determine more closely when any such changes had taken place. Their use here is to provide an example of the procedure used in assigning assemblages to periods.

Protocols

A set of protocols was developed for the use of radiocarbon determinations in the project, and these are outlined below as a series of steps.

1. *Analytical units*. The unit of analysis was the archaeological assemblage, defined here as the material from a discrete period of activity at an archaeological site. Where a site contained multiple layers, or had spatially separated excavation areas the chronological data from these were compared (see 5 below) to determine whether they were synchronous and could be combined. Material from layers or excavation areas that did not have admissible chronological information (see 3 below) was excluded.

2. *Locating and checking radiocarbon data.* A thorough review was undertaken of published archaeological literature, student theses, reports lodged in the N.Z. Historic Places Trust Digital Library and the N.Z. Radiocarbon Database (www.waikato.ac.nz/waikato/nzcd) for radiocarbon determinations from assemblages with suitable faunal data. All dates reported in publications were checked against the N.Z. Radiocarbon Database or in some cases with the laboratory concerned to ensure accuracy of the Laboratory number, Conventional Radiocarbon Age (CRA), standard error, delta ^{13}C, sample material identification and provenance.

3. *Sample suitability criteria.* All dates were examined against the sample suitability criteria listed by Anderson (1991), Petchey (1999) and Schmidt (2000), with those not meeting the criteria excluded. There are two important exceptions to this. Anderson's criteria were established to assist in clarifying the date of first settlement in New Zealand, so deliberately excluded any dates younger than 250 radiocarbon years BP. For broader analytical questions such dates can be very useful, and were included as long as they meet other suitability criteria. Dates on unidentified charcoals are usually eliminated on the grounds that they may incorporate an unknown but potentially large inbuilt age. However when such samples give a young age (i.e. dating to either the Late or Historic period) they can be admitted as evidence for a maximum age of the deposit.

4. *Calibration.* All admissible radiocarbon determinations were calibrated, using the SH04 calibration curve (McCormac, *et al.* 2004) for terrestrial samples, and for marine samples the Marine 04 calibration curve (Hughen, *et al.* 2004) with delta R set at −7±45, as recommended by the Waikato Radiocarbon Dating Laboratory (Petchey pers. comm.).

5. *Treatment of multiple determinations.* Multiple determinations on the same material type for any assemblage were tested for significance of difference, and if indistinguishable, a pooled mean age was calculated (Ward & Wilson 1978) and this was used rather than the individual determinations. Where multiple determinations were on different material types, the overlap between their calibrated age ranges was used as the best estimate of assemblage age.

6. *Assigning assemblages to periods.* Both 1σ and 2σ calibrated age ranges were examined in assigning assemblages to the periods defined above. Where both ranges fell entirely within a single period, or when the 2σ range extended beyond a period boundary by <50yrs the assemblage was assigned to that period. Where both ranges overlap a period boundary, or the 2σ range crossed one by ≥50yrs the assemblage was assigned to an 'overlap' period – i.e. Early/Middle, Middle/Late (Figure 1). The only exceptions to this were some of the most recent assemblages where calibrated age ranges typically extend well into the historic period. For many of these, historical and traditional information, along with the absence of European artefacts and/or historically-introduced fauna allowed secure placement within the Late period.

Case-Study

In total 313 radiocarbon determinations were available for the 107 assemblages under study with 242 of these meeting sample suitability criteria (Smith & James-Lee 2009: Appendix 1). Using the above protocols 63% of the assemblages were assigned to a discrete period, with the remain-

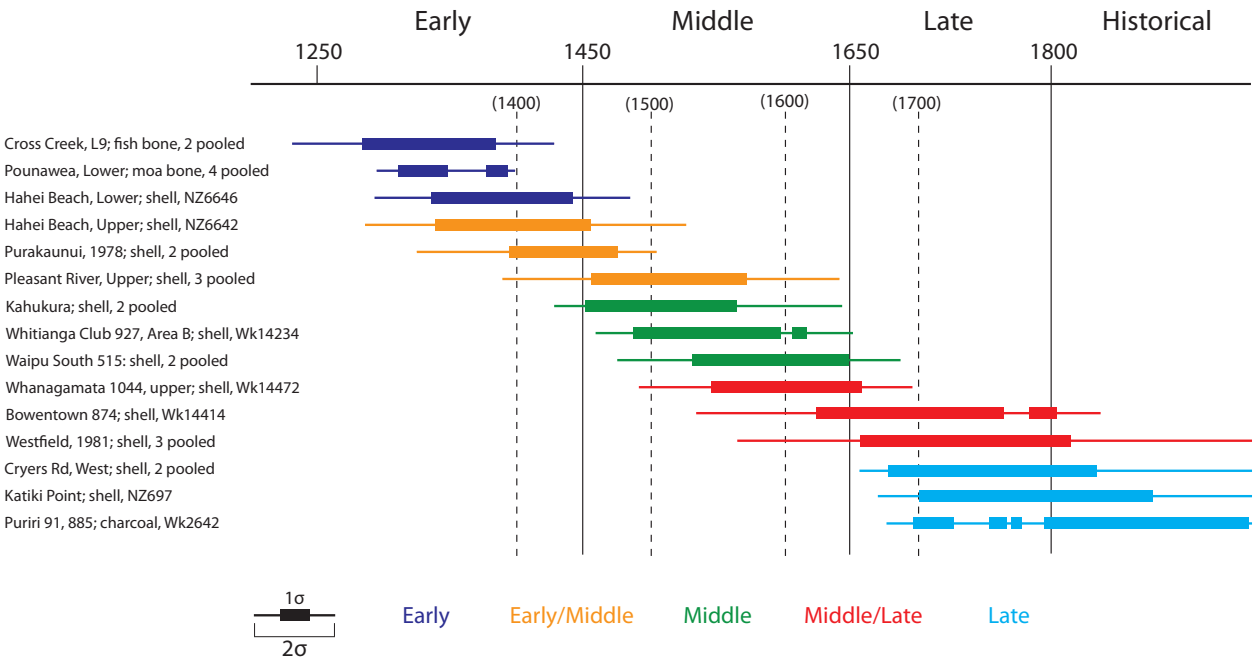

Figure 1. Selected age determinations showing allocation to time periods (Data from Smith and James-Lee 2009: Tables 1 & 2, Appendix 1).

ing 37% assigned one of the two overlap periods (Table 1). Comparative analysis of archaeozoological data from these assemblages is in preparation for presentation elsewhere (Smith n.d.a, n.d.b), but two brief observations on the distribution of study assemablages can be made here to illustrate the potential of the approach.

Table 1. *Temporal Distribution of Study Assemblages.*

Period	Greater Hauraki	Otago-Catlins	Total
Early	8	10	18
Early/Middle	11	9	20
Middle	25	2	27
Middle/Late	18	2	20
Late	13	9	22
Total	**75**	**32**	**107**

The east coast of the Coromandel Peninsula was long ago recognised as an area productive of artefacts and fauna generally thought to derive from early in the prehistoric sequence (Golson 1959; Davidson 1979). However these observations derived from a time when relatively little archaeology had been conducted throughout the inner Hauraki Gulf and along the coast immediately to the north. There have now been many investigations in the latter area, and more than half of the sites examined in the Greater Hauraki study region derive from there. Nonetheless, all but one of the assemblages from this region assigned to the Early period, and eight of the eleven assigned to the Early/Middle period, derive from the east coast of the Coromandel making a strong case that initial prehistoric settlement was focused there rather than in the inner gulf and on the mid-north coast.

For southern New Zealand it has frequently been proposed, although seldom with strong supporting evidence, that human population size declined or at least stagnated after the initial settlement period (e.g. Anderson & Smith 1996). In this regard it is notable that in the Otago-Catlins study sample only two assemblages are assigned to each of the Middle and Middle/Late periods, which may reflect the relative size of human population at that time. For both this and the Coromandel example it needs to be noted that the present study samples do not include all available dated sites; in each case some were eliminated because they lacked suitably quantified faunal data. Clearly further assessment is warranted for both the propositions made here. The protocols offered above for organising dated assemblages provides one of the strategies by which this could be achieved.

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